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REPORT

ON THE

Climatology of Kansas,

BY

TIFFIN SINKS, M. D.

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INTRODUCTION.

LEAVENWORTH, KANSAS, December 30, 1865.

PROF. G. C. SWALLOW, *State Geologist*—

DEAR SIR:—I herewith submit my Report on the Climatology of Kansas. My design has been to collate the most important practical facts upon the subject, and state them in as concise language as possible. As this is to accompany your preliminary report, an exhaustive analysis has not been attempted.

Hoping that it will meet with your approval, and contribute somewhat toward placing Kansas in her true position,

I remain, very respectfully,

Your obedient servant,

TIFFIN SINKS.

CLIMATOLOGY OF KANSAS.

The agricultural resources of any country are largely dependent upon its climate, whatever may be the character of its soil. An early acquaintance, therefore, with tabulated observations, will save a considerable portion of the time and labor that would otherwise be expended in experiment.

The average results of meteorological observations for a series of twenty years, will vary but little from those for any greater series; the seasons traveling, apparently, in cycles of about twenty years each. By a wise provision of Government, meteorological observations have been made and recorded at all the military posts in the United States, since the year 1819. The measurements of rain, however, were not begun until 1836.

We have thus, in our early history as a State, a large fund of valuable information collected for us by disinterested parties.

The tables included in this report have been carefully arranged from the records of the United States Medical Department, and in some respects are as complete as is necessary for practical purposes.

The points selected for comparison, with the exception of Fort Kearney and Pittsburg, all lie within the same parallels that include the State of Kansas, are west of the Alleghanies, and are about equally exempt from, or exposed to, maritime influences. Their agricultural capabilities have been subject-

ed to practical tests for a long series of years, and the results are matters of statistical record.

By a comparison of meteorological records, (other things being equal,) we will arrive at both the relative and positive capabilities of Kansas.

Fort Kearney, although in Nebraska, is the farthest station west, and at the same time within the meridians that include the State of Kansas, at which observations have been made for any considerable period, and is, therefore, included in the table.

TABLE NO. 1.

Table of Mean Temperature for Months, Seasons and Years.

	Latitude	Longitude	Altitude—Feet	January	February	March	April	May	June	July	August	September	October	November	December	Spring	Summer	Autumn	Winter	Maximum	Minimum	Year
Fort Leavenworth	39°21′	94°44′	896	28°00	31°15	42°22	55°47	63°64	71°31	76°67	74°16	66°16	54°46	40°36	29°77	53°76	74°05	53°66	29°76	108°	—30°	52°81
Fort Riley	39.00	96.30	1,180	24.73	31.49	44.06	56.03	67.47	76.40	82.26	78.71	72.55	55.60	40.13	27.73	55.85	79.12	56.09	27.98	106	—23	53.47
Fort Scott	37.45	94.35	1,0 0	32.91	34.98	43.13	55.72	65.48	72.11	77.22	75.53	68.62	55.23	41.91	31.09	54.75	74.95	55.27	32.93	98	—10	54.48
Fort Larned	38.15	99.2	1,780	27 18	35.09	43.03	52.92	56.43	73.49	79.84	78.98	70.28	52.36	40.39	34.09	50.76	77.43	54.34	32.12			53.66
Fort Kearney	40.38	98.57	2,36	21.14	26.11	34.50	47.13	58.81	68.51	73.56	72.33	64.42	49.56	34.07	21.87	46.81	71.47	49.35	23.04	102	—28	47.66
St. Louis	38.40	90.05	450	31.44	33.43	4 .3	55.08	65.07	74.20	78.22	76.16	69.58	54.20	42.55	31.93	54.15	76.19	55.44	32.27	107	—18	54.51
Cincinnati	39.05	84.29	500	33.50	34.10	43.40	54.50	63.50	71.10	76.30	73.70	65.50	53.00	42.30	33.80	53.80	73.70	53.60	33.80	106	—17	53.70
Pittsburg	40.32	80.02	704	29.25	31.16	39.02	49.96	60.92	69.22	72.98	71.21	63.58	50.91	39.80	31.35	49.97	71.47	51.43	30.59	100	—18	50.86

TOPOGRAPHY.

The State of Kansas lies between 37 and 40 deg. north latitude, and between 94 deg. 30 min. and 102 deg. west longitude. The eastern border is elevated 900 feet above the level of the sea, and gradually ascends toward the west at the rate of about three feet per mile. The surface is that of gently undulating prairie, interspersed with numerous streams, the margins of which are skirted by timber.

The general direction of the principal streams is from west to east.

The eastern half of the State is abundantly supplied with timber for all practical purposes; from Fort Riley to the western border it rapidly diminishes, both in amount and quality. There is nothing in the vertical configuration that would, in any degree, influence the local climate. Uniformity in character and appearance is patent to the observer. Extending through three degrees of latitude, a corresponding difference would be expected between the temperature at the northern and southern borders, during the spring and autumn months.

The intrusion of the Great Plains on the west exerts a marked influence upon the climate, the details of which will be given in their appropriate place.

The natural drainage of the State is most excellent, the descent of the beds of the streams being sufficiently great to produce rapid currents.

There is an entire absence of lakes, swamps, or marshes, and the streams seldom overflow the alluvial bottoms along their course.

TEMPERATURE OF THE THREE MONTHS OF SPRING.

The thermal calculations, in Table No. 1, are made from mean quantities only, as being the best approximation to positive and unalterable quantities, as well as contributing to brevity.

The distribution of heat for the three months of spring, at all the points mentioned, is characterized by great variability in successive years, as well as constant differences of the months, but the advance in mean temperature from March to

April, and from April to May, is quite uniform for any one season.

March is sometimes a full winter month, and May a full summer month; but this so seldom occurs that it may be called an exception. In these instances compensation is usually made by an early or late winter in the same year.*

The course of the isothermals, for the season as a whole, in reference to the points included in the above table, varies but slightly from the parallels of latitude, and practically may be considered the same. Similarly, the monthly increase of heat from March to April, and from April to May, is the same, being an increase of about ten degrees for each month. The irregular non-periodic distribution of heat shows a marked difference, the extremes being greater in Kansas than in any of the States further east.

This is perhaps due to the influence of the plains. The breezes sweeping down the slopes of the Rocky Mountains, having an unopposed transit across the intervening country, expend their chief influence upon Kansas. Another fact, and one that cannot be expressed in tabular form, is, that during this season the transitions of temperature are sudden as well as great.

This is a feature of great practical importance to the Kansas farmer, especially to the horticulturist, and deserves a full expression.

It is not only important to know the mean temperature for each month, but, also, the greatest variation above and below the mean; to what extent we may expect the thermometer to fall, at any single observation, in each of the spring months, and the very highest and lowest point possible to be attained in a series of years.

The following tables exhibit this distribution of temperature.

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* The month of March, 1865, was a full winter month, and the succeeding September a full summer month.

TABLE NO. 2.

General Range of Mean Temperature.

	MARCH.					APRIL.					MAY.					
	Highest Mean Temperature..	Lowest Mean Temperature....	Range.....	Date of Maximum.....	Date of Minimum.....	Highest Mean Temperature....	Lowest Mean Temperature....	Range.....	Date of Maximum.....	Date of Minimum.....	Highest Mean Temperature....	Lowest Mean Temperature....	Range.....	Date of Maximum.....	Date of Minimum.....	Number of y'rs Observed.....
Fort Leavenworth	43°4′	17°4′	3[illegible]°	1842	184[illegible]	64°0′	45°0′	18°9	1839	1850	67°1′	59°3′	7°8′	1853	1837	34
Fort Riley	52.4	38.1	14.3	1860	185[illegible]	6[illegible].4	53.3	10.1	1855	1862	72.3	59.9	13.4	1860	1857	10
Fort Kearney	45.7	31.7	14.0	1860	1850	54.3	37.7	16.6	1855	1857	65.4	53.5	11.9	1860	1853	16
Fort Scott	49.3	24.5	24.8	1869	1843	63.2	48.5	14.7	1844	1850	69.5	61.5	8.0	1851	1847	10
St. Louis	57.8	25.5	33.2	1842	184[illegible]	65.6	48.5	17.1	1845	1850	73.7	57.5	16.2	1829	1838	27
Cincinnati	52.5	28.8	23.7	1842	184[illegible]	64.2	48.3	16.9	1844	1837	67.0	56.7	10.3	1846	1838	24
Pittsburg	46.7	23.0	0.7	1862	184[illegible]	59.5	44.4	15.1	1844	1852	65.4	53.9	11.5	1842	1850	27

Table No. 2 exhibits the highest and lowest mean temperature ever observed for each of the spring months, the range and the dates of each. For those points at which records have been kept for twenty years in succession, they probably express as great extremes as will ever again occur.

TABLE NO. 3.

	MARCH.		APRIL.		MAY.	
	Mean Maximum.	Mean Minimum.	Mean Maximum.	Mean Minimum.	Mean Maximum.	Mean Minimum.
Fort Leavenworth	73°	13°	81°	28°	8[illegible]	41°
Fort Riley	77	15	87	27	89	43
Fort Kearney	70	7	80	21	86	32
Fort Scott	73	13	82	29	86	39
St. Louis	73	6	84	30	87	44
Cincinnati	69	19	82	31	84	41
Pittsburg	67	12	77	23	84	36

Table No. 3 exhibits the mean maximum and minimum temperature, calculated from the extremes of each month for the whole number of years. The measures are those that may be expected at some period in each month for any year.

TABLE NO. 4.

	MARCH.				APRIL.				MAY.			
	Maximum.	Minimum.	Date of Maximum.	Date of Minimum.	Maximum.	Minimum.	Date of Maximum.	Date of Minimum.	Maximum.	Minimum.	Date of Maximum.	Date of Minimum.
Fort Leavenworth	85°	-4°	1852	1843	96°	15°	1855	1851	90°	32°	1850	1850
Fort Riley	85	5	18 4	1855	95	18	1855	857	99	37	1856	1857
Fort Kearney	82	4	1857	1857	92	10	1855	1857	94	26	1856	1851
Fort Scott	87	-10	1852	1848	87	22	18 3	1851	90	31	1852	851
St. Louis	85	0	1845	1848	94	17	1845	1857	92	32	18 5	851
Cincinnati	76	4	1851	1858	89	21	185	1857	9	31	185	1851
Pittsburg	82	-4	1848	1856	86	18	1844	1855	90	28	1846	851

Table No. 4 exhibits the greatest and least temperature ever observed, and the date of each. As in Tables Nos. 2 and 3, the range in Kansas is decidedly greater than in the other States represented.

The simple fact that a low degree of temperature may be reached during any of these months, is, of itself, unimportant, but when coupled with the fact that the transition from high

to low, and the reverse, may be both great and sudden, it becomes of peculiar interest, and should always be considered as a possible occurrence, any year, to be guarded against.

It is a common practice, in the Eastern and Middle States, to plant orchards and vineyards upon southern slopes.

This is bad practice in Kansas, for the reason that the sap is stimulated too early in the spring, and the trees and vines exposed to these sudden depressions of temperature during the most critical period in their existence. By reversing the process, and planting vines and fruit trees upon high northern exposures, the circulation of the sap is retarded, and the danger materially lessened. The summers are abundantly warm and long to fully mature the fruit. The best evidence of the correctness of the above consists in the experience of fruit growers in Western Missouri. The orchards in that region, upon high northern exposures, are not only more hardy, more productive, and longer lived, but also more certain to produce each year than where southern exposures are selected. Another fact bearing upon this point is, that the trees affected by these transitions of temperature invariably show the blight upon the southern side.

By reference to Table No. 3 it will be observed that the mean maximum temperature for March is 73 deg., and the mean minimum 13 deg., giving a range of 60 deg. that may be expected any year. During the month of March, 1852, the greatest temperature was 85 deg., and the least, 16 deg.

A variation of 40 deg. from noon until midnight is not an infrequent occurrence during this month.

These peculiarities of climate are fixed and definite, and however much the early buds may promise, a killing frost will frequently come to disappoint the hopes. The limiting period for frosts in Kansas is the last of May.

They so seldom occur, however, after the 15th of this month, that this date may be practically considered the frost limit. The distribution of temperature for these months being of vastly greater importance than for any other months, a full expression has been given to all the prominent features.

DISTRIBUTION OF HEAT FOR THE THREE MONTHS OF SUMMER.

An analysis of the thermal distribution for each of the summer months is quite unnecessary, for the reason that during neither of them is there sufficient elevation or depression of temperature to destroy vegetation. In Table No. 1 the thermal mean is given for each. The mean for the season is 74 deg. for the eastern border of the State, with a slight progressive increase to about the 97th meridian, where it is 98 deg. From this point the isothermal bends pretty sharply towards the south.

During this season, the extremes of temperature reverse their order in the spring months, and show a preponderance above rather than below the mean.

The isothermals of 70 and 75 deg. include the States of Iowa, Illinois, Indiana, Ohio, Kentucky, Upper Tennessee, Virginia, Maryland, Delaware, Pennsylvania and New Jersey. The State of Kansas shows a little higher temperature than either of these. This is perhaps due to the influence of the Plains.

The radiation of heat from this immense surface, and particularly from the sandy region southwest of the Arkansas river, produces a marked effect upon the atmosphere, which, when circumstances are favorable, is felt as far east as the Mississippi river. On the 9th of July, 1860, from 10 o'clock in the morning until 6 o'clock in the evening, a dry hot wind blew from the southwest, varying in temperature from 108 to 112 deg. Fahrenheit. A similar hot wind came from the same quarter September 2d, 1864.

This temperature, however, was only manifested when the thermometer was exposed to the direct current of air. During this time the clouds were traveling in an exactly opposite direction, and apparently quite low.

The lower hot stratum had evidently traversed a considerable distance, accumulating heat in its march, without having found a break in the upper stratum through which to pass and distribute its excess of heat.

In respect to temperature, the summer in Kansas is four months in duration rather than three: beginning usually

about the 15th of May and extending to the 15th of September. The daily mean temperature for the month of September, 1865, did not fall, at any time, below 70 deg.

ISTRIBUTION OF TEMPERATURE FOR THE AUTUMN MONTHS.

The thermal mean for the autumn months, as a whole, is of much less practical importance than that of each month separately, and therefore particular mention will be made of single limiting temperatures, with reference to their effect upon vegetation.

The mean for the season will be found in Table No. 1. By reference to this table it will be observed that the mean temperature for this season conforms more strictly to the lines of latitude than that for any other season of the year.

In the following table the mean maximum and minimum temperature are given for each month, as an expression of what may be expected any year.

TABLE NO. 5.

Mean Maximum and Minimum Temperature.

	SEPTEMBER.			OCTOBER.			NOVEMBER.		
	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.
Fort Leavenworth	90°7	44°1	46°6	83°0	27°4	55°6	67°5	14°5	53°0
Fort Riley	94.6	44.6	50.0	82.6	32.0	50.6	69.0	14.5	54.5
Fort Kearney	83.1	34.0	49.1	84.4	19.8	64.6	63.4	9.0	54.4
Fort Scott	92.1	49.7	41 4	84.4	27 8	56.5	72.8	15.7	57.1
St. Louis	93.3	43.6	49.7	81 5	30.0	51.5	68.5	20.7	47.8
Cincinnati	88.6	48.8	39.8	77.5	33.7	43 8	68.5	26.8	41.7
Pittsburg	87.3	41.3	46.0	73.5	29.0	44.5	64.[illegible]	18.5	[illegible].5

The decline in mean temperature from September to October and from October to November, is quite uniform, being about 12 deg. for each. There is an almost exact accordance, in mean temperature, for the months of March and November, April and October, and May and September. The range, however, is much greater for each of the spring months. Novembr, like March, is characterized by sudden transitions in temperature.

At 12 A. M., November 25th, 1864, the sun was shining brightly, and the thermometer stood at 50 deg. At half-past

twelve the wind suddenly veered to the northwest, and swept down with a freezing temperature. At 12 P. M., the mercury had descended to 4 deg. above zero.

These sudden transitions during March and November are common to all the temperate latitudes, but they are much greater and more frequent in Kansas than in the States east of the Mississippi river.

The single extremes may be stated in general terms, without resorting to a tabular form, and as they are only of importance for the month of September, will not be given for either of the other months. In 1844 and 1851 frosts were observed at each of the localities in the above table on the 25th of September. The occurrence of destructive frosts during this month are very rare, however; but after this month they may be expected at any time. November is the only month that shows a mean minimum temperature of 32 deg.

TEMPERATURE FOR THE WINTER MONTHS

A minute analysis of the distribution of temperature for the winter is not of material importance to the agriculturist. For the purpose of comparison, however, the mean temperature for each of the months and the season is given below:

TABLE NO. 6.

MEAN TEMPERATURE FOR THE WINTER MONTHS.

	Dec.	Jan.	Feb	Sea'n
Fort Leavenworth	29°77'	28°00'	31°15'	29°64'
Fort Riley				
Fort Scott	31.09	32.91	34.98	32.93
Fort Larned	34.09	27.18	35 09	32.12
Fort Kearney	21.87	21.14	26.11	23.04
St. Louis	34.93	31.44	33.43	32.27
Cincinnati	34.80	33.50	34.10	33.80
Pittsburg	31.35	29.25	31.16	30.59

It will be observed, by reference to the foregoing table, that the average temperature for the winter in Kansas is a little below that of the States further east, and that there is a gradual reduction in the State itself from the Missouri river westward.

The range is very great and the position of the minimum, with reference to a particular month, very irregular in any winter.

The greatest degree of cold is just as likely to occur in

one month as another, as is shown by the close resemblance of the means for each.

While extreme depressions of temperature are common to this season, the winters are not continuously cold. The mercury rarely remains at or below zero, of Fahrenheit, for a longer period than three days in succession.

The foregoing analysis discloses the fact that in all essentials the temperature of Kansas is the same as that of the States of Missouri, Illinois, Indiana, Ohio and Pennsylvania, and that as far as the temperature alone is concerned, is adapted to the same productions.

DISTRIBUTION OF RAIN.

The precipitation of rain for the seasons and years in Kansas is invested with peculiar interest, and a corresponding effort has been made to indicate clearly its character. Unfortunately for the State much has been said and written upon this subject that will not bear the test of investigation. Individual opinion is so largely dependent upon success or failure in any enterprise or location that it is utterly unreliable. The following table has been carefully arranged from the records of all the observations made at the military posts within the State, extending to the year 1865.

For the stations not within the State, the records accessible are to the year 1860, except Fort Kearney, which extends to 1864.

The number of years during which observations were made, are given for each locality. A fuller expression might be given by including in the table the amounts for each month and year, but the consolidated results, as given, are deemed sufficient for the present purpose. Those who are curious can examine the records as published by Government. The amounts are expressed in inches and hundredths. The measure of snow is made after it has been melted.

TABLE NO. 7.

Mean Precipitation of Rain, Calculated for Seasons and Years.

	Spring.....	Summer....	Autumn....	Winter.....	Year.	No. Years.
Fort Leavenworth	7.34	13.03	7.57	3.42	31.34	39
Fort Riley	5.62	10.08	5.87	2.72	24.90	5
Fort Scott	12.57	16.37	8.33	4.79	42.12	10
Fort Larned	3.36	8.45	4.01	.81	8.63	4
Fort Kearney	6.80	10.62	4.85	1.50	23.77	13
St. Louis	12.30	14.14	8.91	6.94	42.32	19
Cincinnati	12.14	13.70	9.90	11.15	46.89	20
Pittsburg	9.38	9.87	8.23	7.48	34 96	18
Athens, Illinois	12.20	13.30	9.20	7.10	41.80	10

The measure of moisture, precipitated in rain and snow, for the entire year, in Kansas, is very considerably below that for the other States represented in the table. By comparing the measurements for the spring, summer and autumn months, however, it will be found that the difference is very slight.

The winter months show a great diminution in the relative amount, but as the deficiency occurs during the absence of vegetation, it is of no practical importance. As a consequence, the roads during this season are usually dry and in splendid condition for travel, thereby rendering transportation easy at the very time the farmer desires to send his heavy produce to market.

The advantages of a dry winter to the stock raiser are undoubtedly very considerable, but the limits of this article do not admit of a detailed investigation. Experience has demonstrated the fact that cattle will subsist throughout the winter upon the prairies alone.

The precipitation of rain for the month of March shows a small increase over the winter months. The quantities are doubled in April, and again doubled in May. The mean maximum occurs in June, and the mean minimum in January.

The greatest amount in one year ever observed at Fort Leavenworth was 59 inches, in 1858; the least amount was 16 inches, in 1843. The greatest at Fort Scott was 62 1-2 inches, in 1844; the least was 29 inches, in 1848. No records were kept at Fort Scott during the year of 1860, but the amount for the summer months was undoubtedly less than at Fort Leavenworth, as was evidenced by vegetation. The

deficiency of rain at Fort Leavenworth in 1843 must have been local, as the records at Fort Scott for the same year show a measurement of 44 inches. Besides, the Indians living in the Territory at that time have no recollection of a drought of a general character.

The amount of snow that falls during the winter is usually very slight, and it remains on the ground but a short time.

As affecting the general routes of transit across the plains, it may be of interest to state that, both as regards the depth of snow falling at one time, and the length of time during which it remains upon the ground, the Smoky Hill route possesses great advantages over any other.

Taking the records at Forts Leavenworth, Riley and Scott as a basis for calculation, the mean annual precipitation of rain for the eastern half of the State is 32 78-100 inches. The mean for the western half is about 24 inches.

The mean for Minnesota is 30 inches, for Wisconsin, 32 inches, and for Michigan, 30 inches.

The drouth of 1860, occurring as it did when the people were poor, and when even under the most favorable circumstances, the productions were not equal to the home demand, became quite notorious, and cast a doubt upon the agricultural capacities of the State that will require years to dispel. A false notion or opinion once adopted is clung to with remarkable pertinacity, for the reason that but few will take the trouble to investigate for themselves.

Lorin Blodget, in his admirable work on the Climatology of the United States, says that "for all portions of the United States east of the Rocky Mountains, the distinguishing features of the distribution of atmospheric precipitation in rain are its symmetry and uniformity in amount over large areas, and in its having a greater amount in the interior than on the coasts for the same latitude, at least as far north as the 42d parallel of latitude. The non-periodic variations of quantity, however, are very great, and, for most of the area, the range, even for a period of three months, may descend to an entire absence of rain, and for single months this entire absence is quite frequent."

Arnold Guyot, in his lectures on Physical Geography,

says: "One of the most characteristic features of the climate of the United States, consists in that changeableness—that extreme variety of temperature, of fair weather and of foul—that uncertainty of the seasons which always keeps the farmer in anxious suspense between the hope of a good harvest and the fear of a drouth."

The above quotations, from men who stand deservedly high in walks of science, are made for the purpose of showing, without entering into details, that the whole area embraced by the temperate zone in North America is subject to drouth.

In 1860, the relative deficiency of rain was quite as great in Southern Missouri, Arkansas and Western Tennessee as in Kansas. In 1854 a general drought prevailed in all the Central States, from the Missouri river to the Atlantic coast.

The following tabular statement will give a better expression of its extent and character than if made in general terms. The statistics are for the summer months only, as this is the period of greater importance in the supply of rain. The drought, however, continued throughout the autumn months, in most of the localities.

	Summer of 1854—inches.	Average for Sum—inches.		Summer of 1854—inches.	Average for Sum—inches
Fort Leavenworth	5.7	13.0	Pittsburg	4.7	9 8
Fort Riley	2.7	10.6	Washington	4.8	12.0
Fort Smith, Ark	4.1	13.9	Norfolk, Va.	3.5	5.1
St. Louis	5.4	14.1	New York	5.1	11.5
Cincinnati	6.2	13.7	Burlington, Vt.	5.1	10.8

A drought so widely extended as that of 1854, is a rare occurrence in this climate. They are usually confined to a much smaller compass, and, at such times, the neighboring districts are supplied with an excess of rain. While a drought is by no means a desirable occurrence, an excess of rain is equally injurious. The general proposition, that the whole Mississippi valley is more damaged in its grain and root crops by an excess of rain than from a deficiency, will scarcely be questioned.

The exact measure of rain, for the seasons and the year, required for the highest productive development, is not ascer-

ingly difficult, if not impossible, to determine for any considerable area. In fixing the quantity for any locality, the character of the soil enters largely into the calculation. As compared with that of the States of Ohio, Pennsylvania and Kentucky, the soil of Kansas requires a less measure of rain to develop its full productiveness.

Prof. Swallow, in his able report, has admirably described its character, qualities, and the peculiarities of its formation. Suffice it here to say that it is light, porous and deep, is readily permeated by moisture, and as readily yields it to the demands of vegetation. The heavy, impervious clay subsoil, common to all the uplands in the States above mentioned, are found here only in very limited areas. Nature, always compensatory, has made equivalent provision for any defects in the relative amount of rain, by spreading, broad-cast over the State, a soil unsurpassed in fertility.

WINDS.

The geographical position of the State—its proximity to the plains—its exposure to the cold currents from the Rocky Mountains and the warm ones from the Gulf of Mexico, the conflict of these with the great normal west wind of the temperate latitudes, all combine to produce confusion from which it is almost impossible to eliminate anything that may be called general. All points of the compass are represented, and quite frequently, during the same day.

The prevailing winds in the summer are from the southwest, south, and southeast; in the winter, from the northwest, north, and northeast, in the order of frequency as enumerated. During the spring and autumn these points are about equally represented. Direct east or west winds, except of a fitful character, are quite infrequent. A continuous south wind for three days in succession is almost invariably followed by rain. The rain, however, is usually precipitated by a reverse current, and the change in the direction of the wind, just preceding the fall of rain, is quite sudden.

The average force of the winds is greater than that for the Central States, east of the Mississippi, and they are also more constant.

The foregoing is a brief statement of the important practical facts in reference to the positive and comparative Climatology of Kansas. From November to March, inclusive, the transitions of temperature are greater in range, more sudden and more frequent than in the Central States, east of the Mississippi river.

This is the characteristic difference, and the only one of any importance. As it chiefly affects the cultivation of fruit, measures of precaution should be taken, both in the selection of hardy varieties and in the location of orchards and vineyards.

For the eastern half of the State, the measure of rain, excepting for the winter, is quite equal to that of Pennsylvania and New York, and is amply large for all the requirements of an exuberant vegetation. West of the 98th meridian, there may reasonably be some doubt as to the sufficiency. The amount for the summer, however, is quite large, and compared with the European plains in like geographical position—those of Eastern Germany and Russia—which sustain a large population, the difference is decidedly in favor of the plains of Kansas.

The valleys of the Arkansas, Smoky Hill, Solomon, Republican, and their branches, are peculiarly rich in grasses, which would seem to be decisive of the general question of the sufficiency of rain.

When this region shall have been reclaimed from the dominion of the wild buffalo and wilder Indian, its productive capacity will be found to be far beyond that accorded to it by geographers. The resistless western march of the hardy pioneer, and the commercial demands for an iron bond connecting the Atlantic and Pacific, will soon crowd them from their haunts, and not entirely imaginative will be the bright picture of quiet homes, cultivated fields, grazing herds and a teeming population spread over the fabled arid plains of Kansas.